

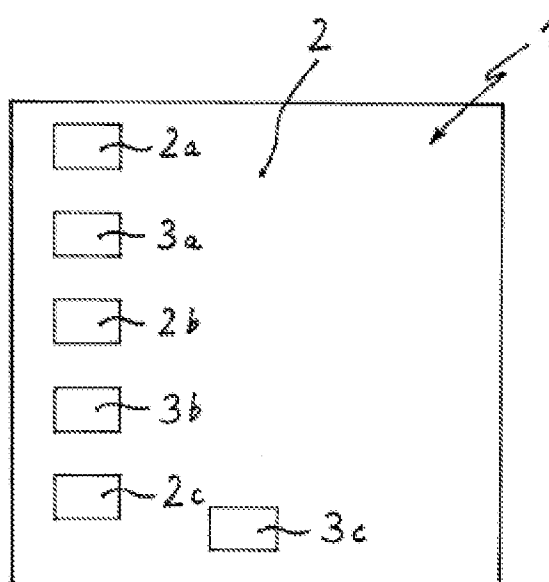
# Selective gold plating of base layer-coated substrate to allow gold and aluminium wire bonding to same substrate

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## Abstract of DE19652991

A process for gold coating of a substrate (1) bearing a base layer (2), in order to form gold-coated first contact areas (2a-c) and gold-free second contact areas (3a-c), involves temporarily covering the second contact areas and then placing the substrate in an exchange gold plating bath. The novelty is that the gold bath has an electrolyte which causes no gold deposition on the base layer (2). Preferably, the base layer is a chemical nickel layer (2) and the gold bath is a reductive gold plating bath, the electrolyte of which preferably contains 0.1-20 g/l potassium, sodium or ammonium gold(I) cyanide or gold(III) cyanide, 0.1-25 g/l free potassium, sodium or ammonium cyanide, 0.1-50 g/l potassium, sodium or ammonium sulphite, 0.01-10 g/l aromatic nitro compound, 1-100 g/l free alkali, 1-50 g/l complex former(s) selected from hydroxycarboxylic acids, phosphonic acids, nitriloacetic acids and ethylenediamineacetic acids and 0.1-50 g/l borane and/or boranate reducing agent.



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The invention relates to a method to at least partial gold coating of a carrier with a base layer, with which first contact surfaces on the carrier, which exhibit a gold layer, and second contact surfaces, which are free of the coated gold layer of the first contact surfaces, become generated, whereby the second contact surfaces become first covered with a taking off means, whereby the carrier becomes introduced into an exchange gold bath, whereby becomes formed on the first contact surfaces a Vorvergoldung, and whereby become remote after the removal of the carrier from the exchange gold bath the second contact surfaces taking off taking off means.

A very popular contacting procedure in the electronics is so called "bonding". Here electrical attachments for an electronic component implemented on the carrier become provided with gold or aluminium wires, whereby usually gold leads in a starch of approx. 30  $\mu$ m or aluminium wires in a starch of approx. 30  $\mu$ m (thin-wire-bond) or 300  $\mu$ m (thick-wire-bond) used becomes.

For this it is required that become disposed on the carrier bondable contact surfaces. While it is possible when bonding aluminium wires to fasten these direct on the chemical nickel layer of the carrier which is with maximum 0.1  $\mu$ m if necessary a thick gold layer strengthened, bonded cannot become, there for this one approx. on such layers with gold lead. 0.3  $\mu$ m thick gold layer required is. This opposite thicker gold layer significant when aluminum wire bonding used layers knows only after a Vorvergoldung of the chemical nickel layer, which a thickness of approx.  $\mu$ m exhibits 0.03 to 0.08, becomes prepared, whereby this Vorvergoldung in exchange electrolytes with a pH value of bottom 7.0 and with approx. 80 DEG C direct on the chemical nickel layer deposited becomes. The reinforcement of these Vorvergoldung on approx. 0.3  $\mu$ m made then in reductional working electrolytes, whereby here a temperature of 80 DEG C and a strong alkaline environment becomes provided.

It is not possible from these reasons up to now to use with the same carrier of simultaneous gold bonding wires and aluminum bonding wires.

It is therefore object of the invention creating a method which it possible that on the same carrier both with gold leads and with aluminium wires bonded can become.

This object becomes dissolved by a method, with which provided according to invention is that the carrier does not become into a gold bath introduced, which exhibits electrolytes with on the base layer of the carrier a gold separation made.

By the measures according to invention will in favourable way a method provided, it in simple way the allowed to plan on a carrier contacting-flat both for gold leads and for aluminium wires. This becomes essentially according to invention achieved by the use of the reductional gold bath, which possesses the advantageous property that on the base layer, in particular a chemical nickel layer, no gold separation takes place, so that these layers are available for bonding with aluminium wire.



top

Favourable developments of the invention are subject-matter of the Unteransprüche.

Other details and advantages of the invention are to be taken from the embodiment, which becomes in the following described on the basis the single fig. It shows:

Fig. 1 a top view on an embodiment of a carrier coated with a chemical nickel layer.

In Fig. 1 represented and carriers referred with 1 exhibits a base layer, in particular a chemical nickel layer 2, at its surface 1' on which contact surfaces are to be applied 2a-2c, which must serve for bonding gold leads and exhibit therefore a gold layer with a layer thickness of approximate 0.3  $\mu$ m gold. Furthermore the carrier 1 exhibits contact surfaces 3a-3c', which serve for bonding aluminium wires and therefore from the contact surfaces 2a-2c training gold layer covered to become to be allowed. The person skilled in the art is apparent that the described arrangement of the contact surfaces, 3a-3c on the carrier 1 serves 2a-2c only for the explanation of the appended described method and is under no circumstances its applicability on other contact assemblies to exclude.

In order to ensure now that the contact surfaces 3a-3c certain for the aluminum wire bonding do not become in the following layers of the described method of in its procedure writings the one which can be manufactured, which become contact surfaces 2a-2c training gold layer covered these contact surfaces 3a-3c with adhesive tape or paint or a similar taking off means covered, certain for the aluminum wire bonding. Taking the contact surfaces off 3a-3c on a variety from for itself known adhesive tapes or paints used can become, since these were up to easily to the thermal and/or chemical loads arising in the subsequent described exchange gold bath.

Subsequent one becomes the so treated carrier 1 in an exchange gold bath, in that a pH value of preferably bottom 7.0 and a temperature of approx. It prevails to 85 DEG C, gilded whereby in to and for itself known way a Vorvergoldung of the contact surfaces becomes 2a-2c with a layer thickness from 0.03 to 0.1  $\mu$ m generated.

After coils and drying of the carrier 1 become by the adhesive tape, the paint or other taking off means the formed covers of the contact surfaces 3a-3c in a known way remote. The contact surfaces 3a-3c abgedenken in the exchange gold bath kept thus their original chemical nickel surface.

In order to train now the contact surfaces 2a-2c for the gold lead bonding, the carrier does not become 1 into a reductional gold bath introduced, electrolytes an used, with on the base layer of the carrier 1, into the here described case of the chemical nickel layer 2, a gold separation made. Here preferred becomes that the electrolyte builds itself up as follows:

The electrolyte points as the first component potassium, sodium or Ammoniumgold I cyanide and/or. the corresponding gold iii-cyanide connections in an order of magnitude of 0,1 g/l to approximate 20 g/l gold up, whereby preferred becomes that the gold content of the aforementioned compounds lies within the range of approximate 0.5 g/l to approximate 5 g/l.

A second component described electrolytes is free potassium, sodium or ammonium cyanide in an order of magnitude of approximate 0.1 g/l to 25 g/l, whereby preferred becomes that the portion of the aforementioned free cyanides lies within the range of approximate 3 g/l to 6 g/l.

Furthermore the electrolyte exhibits potassium, sodium or ammonium sulphite in an order of magnitude of approximate 0.1 g/l to 50 g/l, whereby preferred becomes that that is appropriate for content of the aforementioned sulfite within the range of approximate 5 g/l to 15 g/l.

Furthermore the electrolyte exhibits an aromatic (mono, those or trichloroethylene) nitro compound, for the example 3,5-Dinitrobenzoesäure, in the order of magnitude of approximate 0.01 g/l to approximate 10 g/l, whereby again preferred becomes that the concentration of the aforementioned acidic ones lies into the range of approximate 0.05 to 1.0 g/l.

An other component described electrolytes is free alkali, which is preferably present as potassium or sodium hydroxide. The concentration of the free alkali lies in the order of magnitude of approximate 1 g/l to 100 g/l, whereby the range of approximate 10 g/l to 25 g/l preferred becomes.

An other component electrolytes are in or several complexing agents from the group of the hydroxy carboxylic acids, phosphonic acids, Nitriloessigsäuren or ethylen-diamine-victory-acidic in an order of magnitude of approximate 1 g/l to 50 g/l with an optimum of 10 g/l to 30 g/l.

Furthermore the described electrolyte exhibits or several reducing agent from the group of the boranes or Boranate, whereby the portion of these reducing agents in the order of magnitude of approximate 0.1 g/l to 50 g/l with an optimum of approx. 1 g/l to 10 g/l lies.

In order to accelerate the reaction electrolytes, optional can be still another reaction accelerator, preferably water-soluble thallium iv-heiress dung a provided, which becomes added in an order of magnitude of 0,1 mg/l to approximate 100 mg/l that electrolytes, whereby the preferred range of the aforementioned compound lies within the range of approximate 1 mg/l to 20 mg/l.

Experiments resulted in that a preferred composition electrolytes reads essentially as follows:

- 1.0 g/l gold as free Kaliumgold I cyanide,
  - 5.0 g/l free potassium cyanide,
  - 50 g/l 1-Hydroxid-ethan-1.1-diphosphonsäure,
  - 10 g/l potassium sulfite
  - 0.2 g/l 3,5-Dinitrobenzoesäure,
  - 22 g/l free potassium hydroxide
  - 5.0 g/l Dimethylaminboran,
- whereby 5.0 mg/l thallium as thallium I sulfate added becomes preferably.

The execution of the reductional gold separation becomes a temperature of approximate 60 DEG to 95 DEG electrolytes and in particular the range from 75 DEG to 85 DEG C of the preferred.

The carrier 1 is left in this gold bath with a temperature of preferably 80 DEG C, to itself a layer thickness of approx. 0,3  $\mu$  gold on the contact surfaces 2a-2c deposited has.

Since the described above electrolyte exhibits the advantageous property the fact that in the reductional gold bath on the chemical nickel layer 2, and thus also on the contact layers 3a-3c no gold separation arises will be appropriate for aluminium strips certain contact surfaces 3a-3c not from the gold layer covered and therefore also after this for procedure writing unchanged forwards.

The carrier 1 exhibits thus to contact layers 2a-2c up, which a thick, for which gold lead bonding exhibit suitable gold layer, and contact surfaces 3a-3c, which are unvergoldet, so that on the carrier 1 both aluminium - and gold leads bonded to become to be able.

Even if the remaining surfaces of the base layer 2, thus in the here described case the contact surfaces 3a-3c, are to become with a thin gold layer coated, then this by the fact achieved becomes that like treated carriers 1 after the reductional gold bath into that other described above exchange gold bath introduced becomes managing, until the free surfaces with a thin gold layer are coated, which is bondable with aluminum bath still. It becomes preferred that their thickness lies more approximate between 0,01  $\mu$  to 0.09  $\mu$ .